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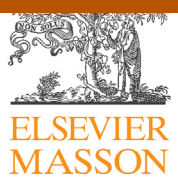

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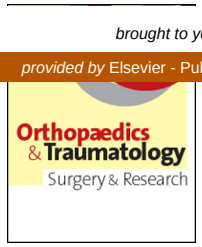

CASE REPORT

Incidental discovery of an undisplaced ceramic liner fracture at total hip arthroplasty revision for squeaking

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Summary Squeaking has been reported after ceramic-on-ceramic total hip arthroplasty (THA), but its pathomechanics is not fully understood. Impaired lubrication is suspected to be the main reason. The management of patients impacted by this phenomenon is not well defined and, as it is not considered to be cause for alarm, revision is not strongly recommended. Here, we describe a ceramic insert fracture discovered during revision surgery performed to correct severe squeaking. Preoperative investigation (plain X-rays, ultrasound and computed tomography) did not reveal ceramic fracture or definite component malposition. To date, there are no other published cases of incidental discovery of a bearing component fracture during revision of ceramic-on-ceramic hip replacement due to squeaking. We believe that squeaking is not a trivial phenomenon and recommend careful management of patients suffering with this symptom.

Introduction

Ceramic-on-ceramic coupling (COC) is known for its resistance to wear and its bioinertia [1]. In contrast to other types of bearings, no metal ions are released, and periprosthetic osteolysis is rare [2]. However, the main drawbacks of these bearings are cup fixation and the risk of component fracture [3,4]. Ceramic fractures may occur spontaneously [5,6] and may be diagnosed during revision for unrelated reasons [7]. Recently, squeaking was reported with COC at

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a frequency ranging from 0.7 to 20.9% [8—10]. This symptom has multifactorial etiologies. Cup [9] and stem design [11,12] has been incriminated, with the lubrication system suspected of being the main causative factor [13]. The natural outcome of squeaking is not alarming, as no related ceramic component fractures occur [14]. Although some authors consider squeaking to be a benign symptom [15,16], it can become socially and psychologically unacceptable, requiring revision surgery [9,15,16].

We report the revision of disturbing and persistent COC total hip arthroplasty (THA) squeaking that allowed the discovery of an asymptomatic ceramic acetabular liner fracture.

Case report

A 43-year-old man, with a body mass index of 27.8 (85 kg, 1.85 m), was referred to our institution for persistent and disturbing squeaking from his right COC hip. Owing to secondary osteoarthritis, his hip had been replaced 3 years earlier through an antero-lateral approach in another institution. Cementless COC components (Amplitude SAS, Neyron, France) with 56-mm cup diameter and 36-mm head diameter were implanted. The bearing components were made of Biolox Forte™ Alumina (Ceramtec, Plochingen, Germany).

Noise started spontaneously 9 months after the index procedure. The patient complained of squeaking sounds as soon as he started walking (Video). Rated as grade 4 according to the classification of William et al. [17], it occurred at every step or change of position. Physical examination was normal and could not reproduce any groin pain. X-rays identified excessive cup inclination (57°) (Fig. 1). Ultrasound detected limited intra-articular effusion but no debris. Stem and cup anteversions were 9° and 22°, respectively, on computed tomography (CT)-scan (Fig. 2). X-rays and CT-scans discerned no breakage of ceramic components. Revision surgery was scheduled considering the severity of squeaking and cup inclination. At surgery, the cup liner was found to be broken, in three large fragments (Fig. 3). We replaced the cup and ceramic head by a new 36-mm ceramic-on-polyethylene bearing. No periprosthetic osteolysis was seen, and synovectomy was not required since no ceramic debris was encountered. The postoperative period was uneventful, and the squeaking disappeared. At 3 years follow-up, the functional and radiological outcomes were satisfactory without signs of osteolysis.

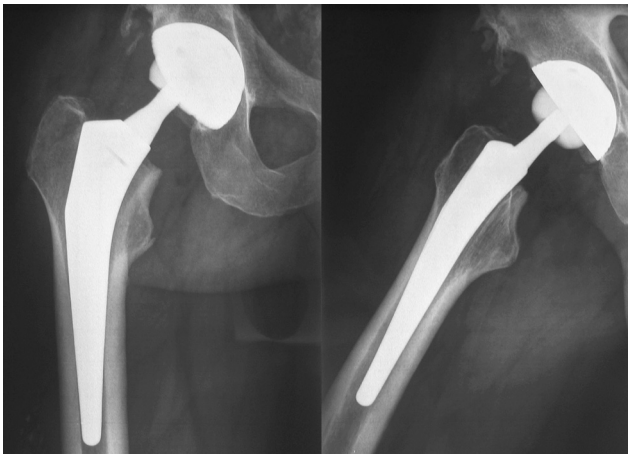

Figure 1 Antero-posterior (AP) and lateral radiographs of patient. The AP view shows excessive cup inclination (57°) that may have favored ceramic liner breakage. There is no evidence of ceramic breakage.

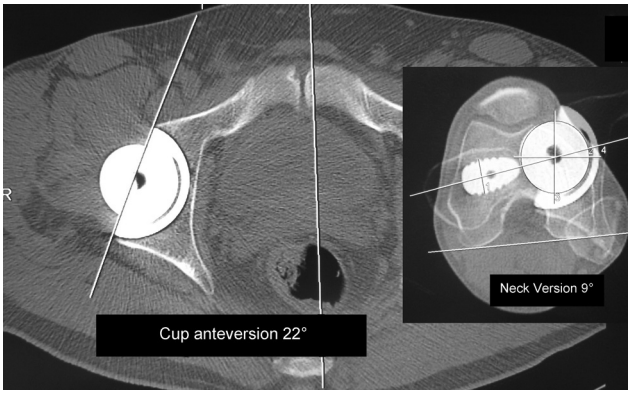

Figure 2 CT-scan showing 22° cup anteversion and 9° for the stem. Liner breakage and ceramic fragments could not be detected on CT-scan.

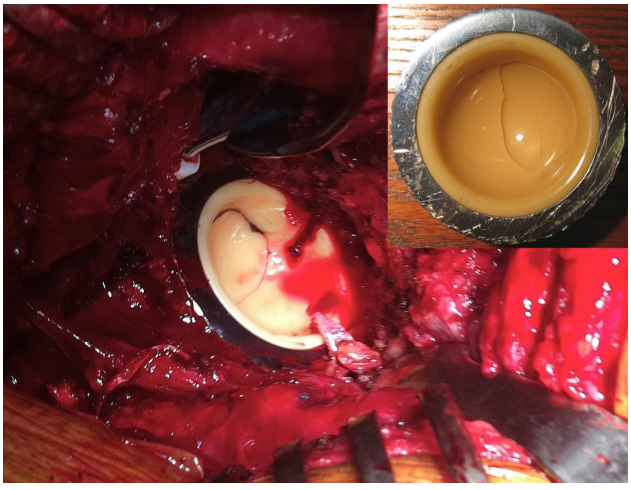

Figure 3 At surgery, the cup liner was found to be broken but not displaced. Three large fragments were observed (postoperative view on retrieval is shown in the insert).

Discussion

The delayed onset of squeaking in the present case was in accordance with previous studies, which reported that this symptom occurs within the first postoperative year [8—10]. To the best of our knowledge, squeaking of bulk COC hip replacement with unrecognized fracture of a ceramic bearing insert has never been described. Only studies of ceramic inserts with polyethylene sandwich have mentioned such complications [3], and the brittleness of these components is well established [18,19]. Finally, no consensus has emerged concerning the management of squeaking COC THA: surgeons skilled in ceramic bearings do not recommend

systematic revision unless radiographic abnormalities have become apparent [20]. Schroder et al. [21] noted squeaking in 1.9% of alumina COC bearings, but did not suggest systematic revision. Our understanding of squeaking phenomenon is deficient: suboptimal component design [12], insufficient lubrication [13], edge-loading wear or micro-separation [22] and inadequate component alignment [8] have been incriminated. In fact, squeaking is considered by many authors to be a minor complication that does not warrant systematic revision [16]. The current study disclosed that squeaking might reveal ceramic component fracture requiring revision.

Our investigation has some limitations. First, we could not ascertain a direct relationship between squeaking and ceramic liner breakage, and we were unable to precisely determine the date of this complication. However, the components deployed in the present study were not reported to be associated with a high frequency of squeaking or ceramic breakage [23]. Chevillotte et al. [23] found 5% cases of squeaking among 100 COC THAs with the same design but observed no liner breakage. Second, another team has already reported previously unrecognized ceramic component fracture that was diagnosed at revision for infection [7]. For comparison with this earlier study, we undertook an extensive preoperative investigation (ultrasound and CT-scan) but were unable to detect liner breakage. Third, breakage of ceramic components occurs with low frequency (0.3%) [4] and requires rapid revision with extensive synovectomy in case of disseminated ceramic debris [6]. We did not perform extensive synovectomy despite ceramic component breakage. In our opinion, extensive synovectomy was not justified because ceramic fragments were not displaced. However, this observation is debatable since the existence of ceramic microparticles cannot be discounted. Fourth, we did not implant a ceramic cup in case of ceramic liner breakage, since the original purpose of revision was to prevent recurrence of squeaking and ceramic breakage. Using a polyethylene insert is debatable when ceramic breakage occurs, but it can simplify revision, embedding potential ceramic debris in polyethylene and being less aggressive on bearing components than hard bearings [6]. The absence of synovectomy and use of ceramic-polyethylene bearing can be discussed, but 3-year follow-up did not reveal osteolysis or abnormal polyethylene wear.

Containment of the broken liner in its metallic shell could explain the absence of radiographic signs and the delayed diagnosis but jeopardized lubrication, thus enhancing squeaking [13]. Excessive inclination (57°) may have contributed to disruption of lubrication and may have favored ceramic liner breakage. However, employing the same prosthetic design with 28-mm bearing and similar thickness of ceramic liner, Chevillotte et al. [23] determined that high inclination was not associated with ceramic liner breakage. The 36-mm head with 56-mm metal back and internal diameter of 44 mm may be another factor that could explain the fracture, since ceramic thickness was only 4 mm at the equatorial aspect. Cogan et al. [20] emphasized that ceramic insert diameter had no influence on squeaking. Traina et al. [24] suggested that malorientation of components, much more than ceramic thickness, was the main cause of ceramic breakage, as in the current study (high inclination). Traina et al. [24] reported high occurrence of squeaking in cases of ceramic breakage that reinforced the need for complete investigation of noisy hips, as in the present work.

The current case report highlights that basic investigations may be insufficient to diagnose undisplaced fractures of ceramic liners, particularly if no small particles are released into the joint. Arthroscopy may be an interesting option, but is limited to date to the resection of grossly loose pieces of hip prostheses [25]. In the present case, hip arthroscopy could be indicated to complete investigations of squeaking hips, after eliminating other possible etiologies, such as component malorientation and impingement, especially if squeaking is frequent or constant.

Our case report indicates that squeaking may reveal ceramic breakage, which is why squeaking requires additional assessments, if conventional radiography is normal. In these cases, hip arthroscopy may be helpful to detect non-displaced liner breakage.

Disclosure of interest

No direct conflicts related to this work.

C.D. Conflict of interest: none.

D.B. Occasional research and education consultant for Medacta.

H.M. Occasional research and education consultant for Zimmer and Tornier; and receives royalties from Tornier.

J.G. Occasional research and education consultant for Zimmer, Wright and Smith and Nephew.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.otsr.2013.05.001.

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